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September 30, 2003

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In Re. Application of:
Stanley H. Kremen
Serial No. 09/853,790
FOR: Methods Of Preparing Holograms
(NEW TITLE: Method For Making A Coordinated And Complementary Set Of Holograms For The Recording And Projection of Images In Substantially 3-Dimensional Format)
Filed: May 11, 2001

Examiner: Alessandro V. Amari
Group Art Unit: 2872

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SUPPLEMENTAL REPLY TO OFFICE ACTION

Dear Sir:

On April 14, 2003, Applicant submitted a new information disclosure statement electronically using Epave v 4.1. The Supplemental Reply to your Office Action of August 12, 2003 is herewith submitted in the form of comments concerning some items referred to in said information disclosure statement. Applicant anticipates that said reply will assist the Examiner with his examination of said application.

Please accept submission of this Supplemental Reply. Thank you for your kind attention to this matter.

Very truly yours,

Stanley H. Kremen

Stanley H. Kremen, Applicant
Registered Patent Agent
Registration No. 51,900

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OCT 01 2003
PATENT & TRADEMARK OFFICE

Docket No.: 102105-162-CIP1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re. Application of:

Stanley H. Kremen
Serial No. 09/853,790
FOR: Methods Of Preparing Holograms
(NEW TITLE: Method For Making A Coordinated And Complementary Set Of Holograms For The Recording And Projection of Images In Substantially 3-Dimensional Format)
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SUPPLEMENTAL REPLY

Office Action Dated August 12, 2003

COMMENTS CONCERNING INFORMATION DISCLOSURE STATEMENT

The present application is a continuation-in-part of US Non-Provisional Application Numbers 09/749,984 (now having matured into US Patent No. 6,593,598) and 09/111,999 (now having matured into US Patent No. 6,229,562), both applications hereinafter to be referred to as the Parent Applications. On August 10, 2001, Applicant submitted an information disclosure statement (IDS) for the present application that is identical to IDS's submitted for the Parent Applications.

On April 14, 2003, Applicant submitted an additional IDS electronically for the present application. This more recent IDS was submitted based upon a recent search by Applicant, which revealed additional U.S. patents having overt similarities to the Present Application, but which, upon further inspection, are not material to patentability.

The second IDS consists of forty-three U.S. patent references. While Applicant believes that all forty-three references have relevance to the Present Application, some are included only to point out the state-of-the-art. Applicant

does not believe it necessary to offer comments concerning those references herein. However, Applicant believes that, some of the patent references in the second IDS, need comments to distinguish them from the material claimed in the Present Application.

The following table sets forth these references. The references are numbered as they appear in the second IDS (of 4/14/2003). Comments are made herein only regarding these references. The comments are numbered according to the reference numbers in the second IDS. Underlining is used for emphasis. The references are as follows:

	PATENT	DATE	INVENTOR
2	3,511,553	05/12/1970	Gerritsen, H.J., et.al.
3	3,533,676	10/13/1970	Lin, L.H.
4	3,533,690	10/13/1970	DeMontebello, R.L.
7	3,547,511	12/15/1970	King, M.C.
9	3,560,070	02/02/1971	Pennington, K.S., et.al.
11	3,560,072	02/02/1971	Silverman, D., et.al.
14	3,657,981	04/25/1972	Benton, Stephen A.
15	3,658,403	12/05/1972	Greenway, David L.
22	3,924,925	12/09/1975	Gale, Michael Thomas, et.al.
24	4,037,919	07/26/1977	Takeda, Y., et.al.
25	4,039,245	08/02/1977	Yano, Akio
26	4,067,638	01/10/1978	Yano, Akio, et.al.
29	4,206,965	06/10/1980	McGrew, Stephen P.
30	4,364,627	12/21/1982	Haines, Kenneth A.
31	4,411,489	10/25/1983	McGrew, Stephen P.
33	4,421,380	12/20/1983	McGrew, Stephen P.
34	4,429,946	02/07/1984	Haines, Kenneth A.
36	4,500,163	02/19/1985	Burns, Richard H., et.al.
37	4,703,994	11/03/1987	Leib, Kenneth G., et.al.
38	4,993,790	12/19/1991	Vick, Gerald L.
39	5,112,121	05/12/1992	Chang, David B., et.al.
40	5,892,601	04/06/1998	Curtis, Kevin, et.al.
41	6,211,977	04/03/2001	Son, Jung Young, et.al.
42	6,392,766	05/21/2001	Gnaedig, Klaus, et.al.

DISCUSSION OF THE REFERENCES

2. **Pat nt No.:** 3,511,533
Date Patent d: May 12, 1970
Inventor: Gerritsen, H.J., et.al.
Title of Invention: Motionless Hologram Imaging

Gerritsen and Greenway in their '533 patent disclose methods of making a composite hologram comprising a multiplicity of microholograms distributed across a recording medium by repositioning a mask or aperture to permit recording individual microholograms. Each microhologram, once prepared and then illuminated with a divergent coherent reference beam, is capable of reconstructing in space the real image of a two-dimensional photograph. One embodiment requires each successive microhologram to be capable of reconstructing a real image in space of a single frame of a two-dimensional motion picture. During playback of the motion picture, the composite hologram does not move, but the reference beam is repositioned to successively illuminate each microhologram one-by-one. Thus, a two-dimensional motion picture may be projected onto a screen without film motion or use of a shutter.

The only similarity between Gerritsen's '533 patent and the Present Application is the incremental recording of a composite hologram comprised of small holograms and the use of a repositionable mask or aperture to prepare said small holograms. This is performed in claims 39, 40, and 2 through 11 (sorted in order of dependency) of the Present Application. Masking a photographic plate to permit exposure of certain portions while protecting other portions from exposure is not novel. This technique is used in manufacturing printed circuits and integrated semiconductor circuits, as well as in taking conventional photographs. Likewise, masking has been used to prepare holograms for decades.

The '533 patent teaches a method of making a holographic array of specific two-dimensional images. The Present Application teaches a method of making a holographic array of optical elements to be used in

reconstructing any of a universe of two or three-dimensional images. Both methods use well known incremental recording techniques through a repositionable mask or aperture, but are otherwise distinguished by the present claim limitations.

The important thing to note is that the hologram of the Present Application performs an optical transformation of an original three-dimensional scene or of an integral photograph thereof to a magnified virtual or real three-dimensional image of the original scene. The small holograms comprising a composite hologram are not produced from individual permanent two-dimensional photographs as in the '533 patent. Instead, the input to the hologram of the Present Application is variable as is the output from said hologram (*i.e.,* it is an optical system that is independent of the information supplied). Furthermore, the reconstruction from the hologram (*i.e.,* a picture) of the '533 patent is necessarily two-dimensional while the reconstruction from the hologram of the Present Application may be three-dimensional.

3. **Patent No.:** 3,533,676
Date Patented: October 13, 1970
Inventor: Lin, L.H.
Title of Invention: Hyperstereoscopic and Hypostereoscopic Image Generation

Lin in his '676 patent discloses the use of integral photography and holography to reconstruct stereoscopic images. The stereoscopic images reconstructed thereby either have enhanced depth (hyperstereoscopy) or diminished depth (hypostereoscopy). In preparing the hologram or integral photograph, the '676 patent teaches the use of vertical strips, each strip representing a three-dimensional scene from a slightly different viewing angle. Vertical parallax is unnecessary and is not present. To prepare a hologram that would reconstruct a hyperstereoscopic image, a Fourier transform hologram is prepared of an illuminated three-dimensional object. The hologram is then physically divided into vertical strips and some of the strips at regular intervals are discarded. The

remaining strips are then repositioned adjacent to one another and in the same order to form a composite hologram which is later illuminated to reconstruct the image. By removing strips, the depth of the three-dimensional reconstruction is enhanced. On the other hand, to prepare a hologram that would reconstruct a hypostereoscopic image, the vertical strips are duplicated, and the composite hologram is formed by positioning the multiple strips adjacent to each other and in the same order. The composite hologram is later illuminated to reconstruct the image. By adding duplicate strips, the depth of the three-dimensional reconstruction is diminished. The same processes of discarding vertical strips and duplicating vertical strips is used to form integral photographs capable of reconstructing hyperstereoscopic and hypostereoscopic three-dimensional images, respectively.

The only similarity of the '676 patent to the Present Application is the fabrication of a composite hologram. However, the methods used for preparing said hologram in the '676 patent as well as the structure and composition of said hologram in the '676 patent is completely different from what is taught in the Present Application. Firstly, the hologram of Present Application is an optical transform device that is not produced by holography of an illuminated object. Secondly, the hologram of the Present Application is not altered by duplication or removal of elements to form a new hologram that would reconstruct three-dimensional images having enhanced or diminished depth properties.

4. **Patent No.:** 3,533,690
Date Patented: October 13, 1970
Inventor: DeMontebello, R.L.
Title of Invention: Photographic Reproduction of Pseudoscopic Real Image Generation Plates

DeMontebello in his '690 patent discloses methods and apparatuses for converting integral photographic three-dimensional pseudoscopic images to three-dimensional orthoscopic images. The '690 patent further discusses very old prior art by Lippmann describing a

similar method of reconstructing orthoscopic images from pseudoscopic images. The Lippman technique is very well known, but the '690 patent claims that its own novel methodology produces a much higher quality image reconstruction. Said methodology involves producing a hologram of the reconstructed pseudoscopic real image of an integral photograph produced using coherent light. The '690 patent discloses that said pseudoscopic image is "blurred" by an aperture scanning technique and vibration so as to reduce the "graininess" or "speckle" of the image. The coherent light may be generated from a monochromatic laser, a polychromatic laser, a mercury vapor lamp, or a distant or collimated incandescent point source.

The method disclosed by the '690 patent is clearly distinguished from the Present Application. "Blurring" of the image reconstruction is the methodology of the '690 patent. Were the "blurring" method taught by the '690 patent to be used in the Present Application, the hologram produced therefrom would not perform as required and would be rendered useless. Furthermore, the input image for the '690 patent is permanent (*i.e.,* characteristic of a picture) while the input image for the Present Application, although fixed, is not an image to be directly comprehended. It the image that will eventually be applied that will be comprehensible to a viewer. The holograms of amended claims 33, 34, and 35 of the Present Application are optical elements that transform a variable input pseudoscopic image to an output orthoscopic image (*i.e.,* it is an optical system independent of the information supplied).

The Lippman technique of producing an output orthoscopic reconstruction from an input pseudoscopic image has been well known for many decades. The pseudoscopic transform of a pseudoscopic image must produce an orthoscopic image. Both the Present Application and the '690 patent employ this prior art methodology. However, amended claims 33, 34, and 35 of the Present Application are dependent upon and limited by claims 1, 36 and 38 (in order of dependency). Therefore, the

holograms produced by the methods of claims 33, 34, and 35 are components of a novel optical system (a combination) that reconstructs a magnified three-dimensional image that is uniformly magnified in all three-dimensions as well as being orthoscopic.

7. **Patent No.:** 3,547,511
Date Patented: December 15, 1970
Inventor: King, M.C.
Title of Invention: Recording Holograms Or Integral Photographs With A Wide Angle View

King in his '511 patent discloses a method of producing a hologram or integral photograph of an illuminated object, said hologram or integral photograph being capable of reconstructing a three-dimensional image of said object wherein said image has a high degree of horizontal parallax. In the apparently preferred embodiment, by shifting horizontal position with respect to the hologram or integral photograph, a viewer observing the reconstructed image would be able to see all around said object from an aspect of 360°. The '511 patent further discloses the possibility of reconstructing said image additionally possessing a high degree of vertical parallax. The disclosed method involves the steps of producing the hologram or integral photograph using a movable mask or aperture, and at the same time, rotating the object being holographed or photographed about an axis. The hologram or integral photograph reconstructs a permanent wide angle three-dimensional image recorded from a specific illuminated object.

The method taught by the '511 patent is clearly different from the method taught by the Present Application. Claims 2 and 9 of the Present Application recite the creation of holograms using movable apertures. However, the Present Application uses two movable apertures while the '511 patent uses only one movable aperture. Furthermore, the holograms produced by the Present Application are optical elements capable of accepting variable input whereas the '511 hologram records a single permanent image.

9. **Patent No.:** 3,560,070
Inventor: Pennington, K.S., et.al.
Date Pat nted: February 2, 1971
Title of Invention: Method For Making Secondary Holograms From Multiplexed Holograms Or Integral Photographs Wherein The Screen Effect Is Eliminated

Pennington and Pole in their '070 patent disclose a method to create a second hologram from a first hologram, with the image of the second hologram having reduced pixelation through a process of "blurring" and Fourier Transform holography. The Present Application does not recite the use of Fourier Transform Holography nor the use of multiplexing by taking several different holograms of the identical image to reduce the grid effect. Furthermore, were "blurring" to be used in the present invention, the hologram produced therefrom would be useless.

11. **Patent No.:** 3,560,072
Date Patented: February 2, 1971
Inventor: Silverman, D., et.al.
Title of Invention: System For The Storage, Retrieval And Display Of Information

Silverman in his '072 patent discloses a method of storing, retrieving, and displaying digital information as microholograms coded with color, grayness, or degrees of transparency. A plurality of information images are recorded and reconstructed at a single position by angle multiplexing the reference beam. In many respects, the hologram produced by this process is very much like an advanced type of microfiche.

The '072 patent teaches a method of making a hologram very different from that of the Present Application. The '072 patent methodology does not utilize first and second optical systems as in claim 1 of the Present Application. The '072 patent methodology does not utilize first and second movable apertures as in claim 9 of the Present Application. Finally, the '072 patent methodology does not utilize an integral photograph as in claim 30 of the Present Application.

14. **Patent N .:** 3,657,918
Dat Pat nted: April 25, 1972
Inv ntor: Benton, Stephen A.
Titl of Inv nti n: Direct Orthoscopic Stereo Panoramagram Camera

Benton in his '918 patent discloses a method of direct recording of a photograph that may reconstruct orthoscopic three-dimensional images without conversion from a pseudoscopic image. The camera produces stereo panoramagrams from stereo images. The configuration of the camera disclosed in the '918 patent is unique to that patent. The optical system and methodology disclosed in the '918 patent does not relate to the optical system and methodology disclosed in claims 33-35 of the Present Application.

15. **Patent No.:** 3,658,403
Date Patented: December 5, 1972
Inventor: Greenway, David L., et.al.
Title of Invention: High Fidelity Readout Of A Hologram Performing The Function Of A Complex Wave Modifying Structure

Greenway and Russell in their '403 patent disclose the fabrication of a hologram to be used as an optical element that modifies a complex input to produce a desired output. It teaches the fabrication of a hologram to be used as a "complex wave modifying structure" acting as though it was a coordinated arrangement of elements such as gratings, lenses, mirrors, and/or prisms, rather than a single lens or mirror. Specifically, the '403 patent teaches a method of producing a hologram capable of functioning as a matrix lens array. Said hologram does not reconstruct a permanent image. Instead, the reference beam is "modulated" so as to be variable, and the nature of the object beam reconstruction is also variable and dependent upon reference beam modulation. One of the uses of said hologram is to produce "high fidelity, high resolution, multi-imaging." The preferred embodiment taught by the '403 patent creates a high quality integral photograph of an object illuminated by diffuse

monochromatic coherent light. The diffuse light is produced using a moving diffuser so as to eliminate laser speckle.

The methodology taught in the Present Application as well as the hologram produced therefrom differs from the teachings of the '403 patent. Claim 1 is the principle limiting claim of the Present Application, and its novelty lies in being able to produce a holographic optical system capable of uniformly magnifying a three-dimensional image. In the '403 patent, the reference beam has a simple wavefront (either collimated or spherical). In the Present Application, the reference beam itself is complex having emerged from a first active optical system containing a plurality of image focusing means.

Claim 23 of the Present Application teaches a method of preparing a hologram capable of producing high quality images that is entirely different from that of the '403 patent. Claim 23 of the Present Application includes all of the limitations of claims 1, 36 and 38 (in order of dependency). The hologram created by the method of claim 23 is a specific type of hologram that is to be used for a specific purpose, and the method of claim 23 is unique to the production of that hologram.

22. **Patent No.:** 3,924,925
Date Patented: December 9, 1975
Inventor: Gale, Michael Thomas, et.al.
Title of Invention: Focussed Image Hologram Projector Using A Long Narrow Light Source

Gale and Greenway in their '925 patent disclose a projector capable of displaying a focused image hologram of a color picture. The projector uses non coherent light for reconstruction. One of the principle embodiments of the projector comprises a plurality of parallel diffraction gratings for different carrier frequencies. The configurations of the projector, as well as the methods taught by the '925 patent for producing the holograms used therein are completely different from what is taught by the Present Application.

24. **Patent No.:** 4,037,919
Dat Pat nted: July 26, 1977
Inventor: Takeda, Y., et.al.
Titl f Inv nti n: Holographic Device With Divided Object Beams, A Multicolor Light Source And Direction Selective Screen

Takeda and Tsunoda in their '919 patent disclose an apparatus that produces a composite hologram comprised of a hologram of each of the two-dimensional views of an integral photograph. By contrast, claims 30-32 of the Present Application concern fabrication of a single hologram that will reconstruct a two-dimensional real image of an entire integral photograph.

25. **Patent No.:** 4,039,245
Date Patented: August 2, 1977
Inventor: Yano, Akio
Title of Invention: Method For Preparing A Hologram

Yano in his '245 patent discloses a method for making a hologram of an integral photograph (often referred to as a panoramic stereogram). The hologram produced by the method of the '245 patent reconstructs a permanently recorded image (*i.e.,* a picture). It is static and not variable, and the resulting hologram is used for projection of a three-dimensional image. The various embodiments of the '245 patent describe methods utilizing Fourier Transform Holography, a corner cube screen, a lenticular screen, and a radially direction selective screen. The methodology of another embodiment produces overlapped holograms. By way of comparison, the Present Application utilizes none of these devices or methodologies. The Present Application describes a method for magnifying and projecting varying three-dimensional images from varying integral photographs that are modulated within the reference beam.

26. **Pat nt No.:** 4,067,638
Dat Patent d: January 10, 1978
Inv ntor: Yano, Akio, et.al.
Titl of Inv ntion: Multi-Color Holographic Stereograms

Yano and Matsumoto in their '638 patent disclose methods for recording and reconstructing multicolored focused image holograms. A composite hologram is constructed from focused images of permanent pictures. The resultant composite hologram is a panoramic stereogram or holographic integral photograph.

Comparing the '638 patent to the Present Application:

The '638 patent teaches fabrication of a hologram only capable of reconstructing a permanent three-dimensional image (*i.e.*, characteristic of a picture). The Present Application teaches fabrication of a hologram capable of reconstructing a variable three-dimensional image (*i.e.*, characteristic of an optical system independent of the information supplied). The methods used in preparing the holograms of the '638 patent are completely different from those used in the Present Application. The optics used in the '638 patent and the Present Application are different.

29. **Patent No.:** 4,206,965
Date Patented: June 10, 1980
Inventor: McGrew, Stephen P.
Title of Invention: System For Synthesizing Strip-Multiplexed Holograms

McGrew in his '965 patent discloses a system for synthesizing a composite hologram comprised of vertical narrow strip holograms positioned adjacent to each other horizontally. Each strip hologram is recorded from and reconstructs a two-dimensional image of a single frame of a projected motion picture film. Each hologram reconstructs a different two-dimensional image of a different frame of the motion picture. One application of a hologram of this type is being able to project a real image of a two-dimensional motion picture where the film moves at constant velocity. On the other hand, the frames of the motion picture can

be taken of a three-dimensional scene, each frame representing a different viewing angle or position. The resulting composite hologram is a holographic integral photograph capable of reconstructing a three-dimensional image possessing only horizontal parallax. Color holograms may be produced by using coherent light of three different wavelengths.

The concept of strip holography is not new. It was invented by DeBitetto during the 1970's. However, many patents have used this technique in combinations that are novel. Comparing the '965 patent to the Present Application, the '965 patent produces a vertical strip integral hologram wherein each hologram is created to reconstruct a single elemental image of an integral photograph. Each strip hologram produced by claims 30, 31, and 32 of the Present Application reconstructs an entire integral photograph. Furthermore, the strip holograms of the Present Application are used to project the reconstructed two-dimensional images into space while the '965 patent uses the reconstructed two-dimensional images from the strip holograms to form a composite hologram capable of reconstructing a three-dimensional image. The '965 patent does not teach projection but rather direct viewing of the reconstructed image. Finally, color images are not produced in the same way in the '965 patent as in the Present Application.

30. **Patent No.:** 4,364,627
Date Patented: December 21, 1982
Inventor: Haines, Kenneth A.
Title of Invention: Method And System For Constructing A Composite Hologram

Haines in his '627 patent discloses a method for the fabrication of a composite hologram comprised of multiple horizontally adjacent vertical strip holograms each of a two-dimensional picture. The composite hologram is a holographic integral photograph. It is intended to be used as a cylindrical or "drum" hologram. Three-dimensional motion picture holography is feasible by rotating the composite cylindrical hologram

around the vertical axis at constant velocity, but the amount of motion is limited by the number of frames used to produce the hologram.

Haines in his '627 patent discloses similar subject matter as McGrew in his '965 patent (#29 discussed above). The '627 patent and the '965 patent produce similar vertical strip holographic integral photographs wherein each hologram is created to reconstruct a specific elemental image of an integral photograph. By contrast, each strip hologram produced by claims 30, 31, and 32 of the Present Application reconstructs an entire integral photograph. Furthermore, the strip holograms of the Present Application are used to project the reconstructed two-dimensional images into space while neither the '627 patent nor the '965 patent uses the reconstructed two-dimensional images from the strip holograms to form a composite hologram capable of reconstructing a three-dimensional image. Neither patent teaches projection.

31. **Patent No.:** 4,411,489
Date Patented: October 25, 1983
Inventor: McGrew, Stephen P.
Title of Invention: System For Synthesizing Strip-Multiplexed Holograms

This is the same subject matter as in the '965 patent (#29 discussed above). The preferred embodiment uses the hologram produced in this reference as a two-dimensional multicolor video projection system. The arguments for comparison of the '489 patent with the Present Application are the same as were used as for comparing the '965 patent with the Present Application. Claims 30, 31, and 32 of the Present Application specifically teach reconstruction, magnification, and projection of an entire two-dimensional integral photograph from each strip hologram. This is necessary for the ultimate reconstruction of a uniformly magnified three-dimensional image in the system developed by the Applicant.

33. **Patent No.:** 4,421,380
Date Pat nted: December 20, 1983
Inventor: McGrew, Stephen P.
Titl of Inv ntion: Full-Color Hologram

This reference was cited on December 6, 2002 in the international search report for international application PCT/US 02/14789 filed by the Applicant on May 10, 2002, said international application being a continuation-in-part of the Present Application. This reference was not previously reported to the Examiner in an information disclosure statement for the Present Application because the Applicant did not consider it to be material to patentability of the present invention. However, at the time that the April 14, 2003 information disclosure statement for the Present Application was prepared, the Applicant felt that disclosure of this reference might help the Examiner when performing his examination of the Present Application. There was no deceptive intent on the part of the Applicant in not previously reporting this reference.

The concept of using three monochromatic colors to additively reconstruct a color image from otherwise non-colored information is not new. It is the basic principle of operation for color televisions and computer monitors. In the prior art, color pixels are comprised of a red, green, and blue component. Earlier color printing processes also used this additive color process.

The '380 patent discloses a hologram which is a composite of three-color component holograms, each non-overlapping component being a vertically focused horizontal parallax hologram. A matched color filter array corresponding to the areas of the composite hologram causes each color component to be reconstructed only by light of the corresponding color.

McGrew, in the '380 patent, teaches how to make various transmission and reflection holograms of pictorial information by piecing together vertical strip holograms specifically recorded from individual

elemental images (*i.e.*, a holographic integral photograph) wherein each strip hologram is recorded using and reconstructs a specific primary color.

By contrast, claims 12 through 22 of the Present Application teach a method of producing a hologram to be used as a screen for projected black-and-white two-dimensional integral photographs, said screen being capable of reconstructing full-color magnified three-dimensional images therefrom. The methodology, the results, and the optics of the '380 patent are entirely different from that of the Present Application.

In claim 12 of the Present Application, a hologram to be used as a front projection screen for reconstructing magnified three-dimensional images is prepared so as to produce a reconstruction of a plurality of adjacent sets of three adjacent parallel vertical lines, each being of a different monochromatic color, when illuminated by white light. No pictorial information is recorded on the hologram as in the '380 patent. Instead, it is the purpose of the holographic screen to filter projected white light into its component monochromatic colors and to focus said light as adjacent vertical lines of light. Projecting a black-and-white two-dimensional integral photograph having only vertical parallax on such a screen will produce a magnified full-color three-dimensional image of the original three-dimensional scene.

34. **Patent No.:** 4,429,946
Date Patented: February 7, 1984
Inventor: Haines, Kenneth A.
Title of Invention: Method And System For Constructing A Composite Hologram

Haines in his '946 patent discloses a composite hologram comprising multiple vertical strip holograms of two-dimensional elemental component pictures of an integral photograph, as well as methods for producing said hologram. The composite hologram forms a holographic integral photograph that is intended to be a cylindrical or "drum" hologram. This patent is related to his 4,364,627 patent (#30 discussed above). The arguments regarding the differences between the '946 patent and the

Present Application are the same as those already presented for the '627 patent.

36. **Patent No.:** 4,500,163
Date Patented: February 19, 1985
Inventor: Burns, Richard H., et.al.
Title of Invention: Holographic Projection Screen

Burns, Mall, and Hildebrand in their '163 patent disclose a holographic screen comprised of a plurality of reflective holograms, each of which, when illuminated with a reference beam from a projector, reconstructs a defined observation pupil. A pupil is the locus of all locations from which the image projected upon the screen may be seen. Therefore, the screen defined in the '163 patent designates where viewers may be situated. It is also suggested that it may be desirable to restrict the observation pupil to exclude certain viewers from seeing the projected image. In the apparently preferred embodiment of the '163 patent, the screen has a spherical shape. The screen is designed for front projection, and the reconstructions therefrom may be multicolored. Each of the elemental holograms is formed with the object beam focused behind the surface of the hologram. All of the elemental holograms are identical. The shape of each elemental hologram is designed so that all of said holograms may be assembled to form the spherical screen that is itself a composite hologram. A movable mask or aperture may be used to form the elemental hologram.

The combination of elemental holograms to form the composite holographic projection screen of the '163 patent necessarily reconstructs an image within a defined observation pupil. The Present Application does not disclose a method of preparing holograms that depend upon a defined observation pupil. Furthermore, the optics for creating the holograms of the '163 patent are different from the optics for creating the holograms of the Present Application. The reference and object wavefronts are completely different.

37. **Patent No.:** 4,703,994
Date Patented: November 3, 1987
Inventor: Leib, Kenneth G., et.al.
Titl of Inv ntion: System And Method For Automatically Fabricating Multi-Hologram Optical Elements

Leib, Peck, and Jue in their '994 patent disclose a method for automatically producing a multi-element composite hologram. A movable mask or aperture is used to create the individual holographic elements. The primary use for the composite hologram disclosed in the '994 patent is for optical correlator systems to detect the presence of a selected target in a scene or a field of view. In the preferred embodiment, a multitude of targets are recorded so that a given target may be identified independently of the viewing angle.

The optical correlation method described in the '994 patent is not relevant to the material disclosed in the Present Application. The '994 patent does not teach the fabrication of a holographic optical element that transforms one wavefront into another (*e.g.,* a holographic matrix lens array). Instead, the patent teaches methods of creation of elemental holograms containing permanent pictorial information. Even though a movable mask or aperture is used to create the composite hologram, the fabrication methods disclosed in the '994 patent are different from those disclosed in the Present Application. The optics are different for both, and the reference and object wavefronts, although complex, are also different for both (see '994 patent: column 7, lines 41-44).

38. **Patent No.:** 4,993,790
Date Patented: December 19, 1991
Inventor: Vick, Gerald L.
Title of Invention: Holographic Lenticular Screen Stereoscopic Avionics Display Apparatus

Vick in his '790 patent discloses a holographic optical element lenticular screen for projection of a 3-D stereoscopic display wherein a viewer's left eye and right eye receive two different two-dimensional stereo images, thereby causing the viewer to perceive a three-

dimensional reconstruction. The methods for producing the holographic screen taught by '790 patent, the optics used by said methods, and the holograms produced by said method are completely different from those taught by the Present Application. In the Present Application, the object is to create a hologram (or coordinated and complementary set of holograms) that reconstructs a uniformly magnified three-dimensional image in space and not to produce a pair of stereoscopic two-dimensional pictures that produce the illusion of depth in the mind of the viewer.

39. **Patent No.:** 5,112,121
Date Patented: May 12, 1992
Inventor: Chang, David B., et.al.
Title of Invention: Display System For Multiviewer Training Simulators

Chang, Moise, and Shih in their '121 patent disclose a holographic screen that directs multiple projected images to specified multiple viewing areas. It is to be used for training simulators that accommodate multiple viewers. Each viewer can observe only that image intended to be viewed by that observer. Therefore, it produces defined observation pupils. Holograms to produce different colors are superimposed over each other. The holographic elements produced, the methods for producing them, and the optics used to produce them are completely different between the '121 patent and the Present Application.

40. **Patent No.:** 5,892,601
Date Patented: April 6, 1998
Inventor: Curtis, Kevin, et.al.
Title of Invention: Multiplex Holography

Curtis and Wilson in their '601 patent disclose processes for production of multiplex holograms using aperturization. The aperturization is performed by restricting the reference beam so as to place an unfocused spot of light onto a particular region of a photographic plate (Example 1), and then stepping the recording of holograms for spatial multiplexing. Example 2 adds a slit shaped aperture in the image plane. Example 3 records an array of 11 × 100 overlapping holograms. The

holograms are reconstructed individually by selectively scanning the entire photographic plate. An essential embodiment of the system of the '601 patent is a composite hologram comprised of partially overlapping elemental holograms.

Claim 9 of the Present Application is dependent in sequence upon claims 2, 40, 39, (36, 37, or 38), and 1, respectively. The dependencies and claim limitations translate as follows:

The Present Application claims a method for producing a multiplexed hologram of an integral photograph (claim 9) from two active optical systems (claim 1). Diffuse coherent light is used along with two apertures -- the first being positioned on the plane of the integral photograph, and the second being positioned on the plane of the photographic plate that will ultimately become the hologram. The sizes and shapes of said first and second apertures are limited by the sizes and shapes of the respective elemental images to which they relate (claim 2). The first and second apertures move incrementally to expose certain portions of the photographic plate and to protect other portions of said plate from exposure (claim 40). This step is repeated until the entire hologram is produced (claim 39). The input reference beam may either be an optical wavefront from a three-dimensional scene (claim 36) or from an integral photograph (claim 9). The hologram (*i.e.,* the fabricated optical system created as a coordinated and complementary set of holograms) produced may be a single hologram (claim 37) or an optical system wherein some components may be holograms and other components may be conventional optics (claim 38). The hologram (*i.e.,* the fabricated optical system created as a coordinated and complementary set of holograms) once fabricated and illuminated with an appropriate reference beam reconstructs a uniformly magnified three-dimensional image from said integral photograph or said three dimensional scene (claim 1).

It should be apparent that, although movable apertures may be used to produce the holographic elements of the '601 patent, the method

for producing the holographic elements in claim 9 of the Present Application is different. The composite holograms are also different, because the holographic elements of the Present Application do not overlap.

41. **Patent No.:** 6,211,977
Date Patented: April 3, 2001
Inventor: Son, Jung Young, et.al.
Title of Invention: Method of Producing A Holographic Projection Screen For Displaying a Three-Dimensional Color Images

Son and Bobrinev in their '977 patent disclose a method of producing a projection screen for three-dimensional pictures wherein different two-dimensional images of a 3-D stereoscopic pair of images are directed to different eyes of a viewer, respectively. Left-eye pictures are directed to the observer's left eye, while right-eye pictures are directed to the observer's right eye. The screen creates viewing zones or observation pupils. This is not the same nor even similar to what is produced by the Present Application, and a comparison of the methods of the patent and the application shows them to be completely different.

42. **Patent No.:** 6,392,766
Date Patented: May 21, 2001
Inventor: Gnaedig, Klaus, et.al.
Title of Invention: Screen For Front Laser Projection

Gnaedig, Dausmann, and Haldorsson in their '766 patent disclose a screen used for front projection of two-dimensional color images at high efficiency. Said screen does not have selective areas or elemental imaging optics that would facilitate three-dimensional reconstruction. The methods for production in the '766 patent and the Present Application are completely different.